AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

What is claimed is:

1. (currently amended) A bipolar plate for an electrochemical cell having a membrane-electrode-assembly (MEA) and capable of operating at a pressure difference across the MEA of equal to or greater than about 50 pounds-per-square-inch (psi), the bipolar plate comprising:

a unitary plate having first and second sides, first and second inlet ports, and first and second outlet ports;

a first plurality of flow channels continuously oriented in a first direction at the first side, a first inlet header channel at one end of the first plurality of flow channels and in fluid communication with the first inlet port, and a first outlet header channel at the other end of the first plurality of flow channels and in fluid communication with the first outlet port; and

a second plurality of flow channels continuously oriented in a second different direction at the second side, a second inlet header channel at one end of the second plurality of flow channels and in fluid communication with the second inlet port, and a second outlet header channel at the other end of the second plurality of flow channels and in fluid communication with the second outlet port;

wherein each of the header channels comprises a support surface sufficient to support the MEA at the operating pressure difference while providing a fluid flow channel from one end of the respective header channel to the other end, and wherein each of said header channels includes third plurality of channels extending perpendicular to the respective flow channels.

2. (original) The bipolar plate of Claim 1, wherein:

the first direction is oriented about 90 degrees to the second direction.

3. (original) The bipolar plate of Claim 1, wherein:

the first inlet port and the first outlet port are diagonally disposed with respect to a fluid flow therebetween; and

the second inlet port and the second outlet port are diagonally disposed with respect to a fluid flow therebetween.

4. (original) The bipolar plate of Claim 1, wherein:

the first side further comprises a first plurality of support ridges in an alternating arrangement with the first plurality of flow channels; and

the second side further comprises a second plurality of support ridges in an alternating arrangement with the second plurality of flow channels.

5. (original) The bipolar plate of Claim 4, wherein:

the first plurality of support ridges have a first width equal to or greater than the width of the first plurality of flow channels; and

the second plurality of support ridges have a second width equal to or greater than the width of the second plurality of flow channels.

6. (original) The bipolar plate of Claim 5, wherein:

the first width is greater than the second width.

7. (original) The bipolar plate of Claim 1, wherein:

the first inlet port, the first inlet header channel, the first plurality of flow channels, the first outlet header channel, and the first outlet port, define a first flow path;

the second inlet port, the second inlet header channel, the second plurality of flow channels, the second outlet header channel, and the second outlet port, define a second flow path; and

the first flow path is isolated from the second flow path.

8. (original) The bipolar plate of Claim 1, wherein:

the unitary plate is made from titanium, zirconium, stainless steel, or any combination comprising at least one of the foregoing materials.

9. (currently amended) The bipolar plate of Claim 1, wherein:

at least one of the header channels comprises an insert, the insert having the support surface <u>on a first side, and wherein said third plurality of channels extending perpendicular to said respective flow channels is formed by protrusions on a second side of said insert</u>.

10. (original) The bipolar plate of Claim 9, wherein:

the insert is made from titanium, zirconium, stainless steel, or any combination comprising at least one of the foregoing materials.

11. (original) The bipolar plate of Claim 1, wherein:

each of the header channels comprises a support surface sufficient to support the MEA at an operating pressure difference across the MEA of equal to or greater than about 100 psi while providing a fluid flow channel from one end of the respective header channel to the other end.

12. (currently amended) An electrochemical cell, comprising:

a plurality of membrane-electrode-assemblies (MEAs) alternatively arranged with a plurality of flow field members between a first cell separator plate and a second cell separator plate;

wherein at least one of the plurality of flow field members comprises a bipolar plate, the bipolar plate comprising:

a unitary plate having first and second sides, first and second inlet ports, and first and second outlet ports;

a first plurality of flow channels continuously oriented in a first direction at the first side, a first inlet header channel at one end of the first plurality of flow channels and in fluid communication with the first inlet port, and a first outlet header channel at the other end of the first plurality of flow channels and in fluid communication with the first outlet port, wherein said first inlet channel and said first outlet channel are perpendicular to said first plurality of flow channels; and

a second plurality of flow channels continuously oriented in a second different direction at the second side, a second inlet header channel at one end of the second plurality of flow channels and in fluid communication with the second inlet port, and a second outlet header channel at the other end of the second plurality of flow channels and in fluid communication with the second outlet port, wherein said second inlet channel and said second outlet channel are perpendicular to said second plurality of flow channels;

wherein each of the header channels comprises a support surface sufficient to support the MEA at an operating pressure difference across the MEA of equal to or greater than about 50 pounds-per-square-inch (psi) while providing a fluid flow channel from one end of the respective header channel to the other end.

13. (original) The bipolar plate of the electrochemical cell of Claim 12, wherein:

the first direction is oriented about 90 degrees to the second direction;

the first inlet port and the first outlet port are diagonally disposed with respect to a fluid flow therebetween; and

the second inlet port and the second outlet port are diagonally disposed with respect to a fluid flow therebetween.

14. (original) The bipolar plate of the electrochemical cell of Claim 13, wherein:

the first inlet port, the first inlet header channel, the first plurality of flow channels, the first outlet header channel, and the first outlet port, define a first flow path;

the second inlet port, the second inlet header channel, the second plurality of flow channels, the second outlet header channel, and the second outlet port, define a second flow path; and

the first flow path is absent fluid communication with the second flow path.

15. (currently amended) The bipolar plate of the electrochemical cell of Claim 14, wherein:

at least one of the header channels comprises an insert, the insert having the support surface on a first side and a third plurality of channels on a second side wherein

said third plurality of channels is perpendicular to the respective flow channels adjacent said insert.

16. (original) The bipolar plate of the electrochemical cell of Claim 15, wherein:

the unitary plate and the insert are made from titanium, zirconium, stainless steel, or any combination comprising at least one of the foregoing materials.

17. (original) A bipolar plate of Claim 1 made by the process of chemical etching at least one of the first side and the second side of the unitary plate to produce at least one of the first inlet header channel, the first plurality of flow channels, the first outlet header channel, the second inlet header channel, the second plurality of flow channels, and the second outlet header channel.

18. (new) An electrolysis cell stack for disassociating hydrogen and oxygen from water, said electrolysis cell stack comprising:

a first membrane-electrode-assembly having a first anode and a first cathode disposed on opposite sides of a first membrane;

a second membrane electrode assembly having a second anode and a second cathode disposed on opposite sides of a second membrane;

a bipolar plate having a first side in fluid communication with said first anode and a second side in fluid communication with said second cathode;

wherein said bipolar plate comprises:

a unitary plate having first and second sides, first and second inlet ports, and first and second outlet ports, wherein the material of said unitary plate in continuous from said first side to said second side;

a first plurality of flow channels continuously oriented in a first direction at the first side, a first inlet header channel at one end of the first plurality of flow channels and in fluid communication with the first inlet port, and a first outlet header channel at the other end of the first plurality of flow channels and in fluid communication with the first outlet port, wherein said first inlet channel and said first outlet channel are perpendicular to said first plurality of flow channels; and

a second plurality of flow channels continuously oriented in a second different direction at the second side, a second inlet header channel at one end of the second plurality of flow channels and in fluid communication with the second inlet port, and a second outlet header channel at the other end of the second plurality of flow channels and in fluid communication with the second outlet port, wherein said second inlet channel and said second outlet channel are perpendicular to said second plurality of flow channels;

wherein each of the header channels comprises a support surface sufficient to support said first membrane and said second membrae at an operating pressure difference across said first membrane and said second membrane of equal to or greater than about 50 pounds-per-square-inch (psi) while providing a fluid flow channel from one end of the respective header channel to the other end.

19. (new) The electrolysis cell stack for disassociating hydrogen and oxygen from water of Claim 18 wherein at least one of the header channels comprises an insert, the insert having the support surface on a first side and a third plurality of channels on a second side wherein said third plurality of channels is perpendicular to the respective flow channels adjacent said insert.